UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/595,203	03/23/2006	Sung Soo Si	2017-072	4577

52706 7590 01/06/2009

IPLA P.A.
3580 WILSHIRE BLVD.
17TH FLOOR
LOS ANGELES, CA 90010

EXAMINER	
DHINGRA, RAKESH KUMAR	
ART UNIT	**PAPER NUMBER**
1792	

MAIL DATE	DELIVERY MODE
01/06/2009	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/595,203	SI ET AL.	
	Examiner	Art Unit	
	RAKESH K. DHINGRA	1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *03* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *14 October 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-11* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-11* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *23 March 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

1) The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claim 2 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

In this case, amended claim 2 recites interalia "the inside of the chamber is symmetrical on the basis of a virtual line connecting a lowest bottom point of the supply port and a center point of an opening of the exhaust port towards the exhaust plate", whereas as per Fig. 1 of the applicant's disclosure lowest bottom point of the supply port 160 and a center point of an opening of the exhaust port 170 are not such disposed that these can be connected by a virtual line about which the inside of the chamber is symmetrical.

Applicant may clarify this based on disclosure or amend the claim appropriately. For the purpose of examination on merits this claim limitation has been interpreted as presently recited in the claim.

2) The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 2 recites the limitation "towards the exhaust plate" in line 4. There is insufficient antecedent basis for the limitation “exhaust plate” in the claim. For the purpose of examination on merits this limitation has been interpreted as “towards the process region in the chamber”.

Response to Arguments

Applicant's arguments with respect to claims 1-11 have been considered but are moot in view of the new ground(s) of rejection as explained hereunder.

Applicant has amended claims 1, 2 by adding new limitations, e.g. in claim 1 new limitation “wherein openings of the first spray hole are substantially perpendicular to openings of the second spray hole", has been added.

Claims 1-11 are presently pending and active.

New references by Kanai et al (US 5,391,232) and Carson (US 3,818,938) when combined with Toyoda et al and Srivastava et al read on limitation of amended claim 1. Accordingly claims 1, 2, 4 have been rejected under 35 USC 103 (a) as explained below. Further, balance claims 3 and 5-11 have also been rejected under 35 USC 103 (a) as explained below.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1, 2, 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Toyoda et al (US 2001/0029112) in view of Kanai et al (US 5,391,232), Carson (US 3,818,938) and Srivastava et al (US 6,761,796).

Regarding Claims 1, 4: Toyoda et al teach a plasma apparatus comprising:

A chamber 1 having a supply port 22 with an outlet 23 and an exhaust port (part of manifold 7A) provided at both ends thereof, with a wafer 4 being mounted in the chamber, a thermal source 12, a gas supply module for supplying process gas (through inlet 8C), a discharge tube 2 (made from quartz) for plasmalizing the process gas supplied from the gas supply module, and a microwave supply apparatus (through waveguide 71) for supplying microwaves to the discharge tube 2, wherein the supply port supplies atomic radicals to the chamber, the radicals being formed by the plasmalization of the process gas in the discharge tube (e.g. Fig. 12 and para. 0095, 0096).

Toyoda et al do not explicitly teach the supply port includes:

an inner tube having one end which is opened and connected to the discharge tube and the other end which is closed, the diameter of a closed portion of the other end being smaller than those of other portions of the other end, and a first spray hole being formed around a side wall of the closed portion; and

an outer tube having one end which is opened such that the closed portion of the inner tube is inserted in the one end, and the other end at which a plurality of second spray holes is formed, the other end of the outer tube being spaced apart by a predetermined interval from the other closed end of the inner tube;

wherein openings of the first spray hole are substantially perpendicular to openings of the second spray holes; and

the thermal source is provided in the chamber and including a plurality of lamps for heating the wafer .

Kanai et al teach a plasma apparatus including a gas supply port 511, comprising an inner tube 511b with spray holes 511a formed around a side wall of the inner tube, and connected to a gas introduction pipe (discharge tube) 409. Kanai et al also teach an outer tube 511c with a spray hole (Toyoda et al already teach plurality of holes in the supply port outlet to obtain uniform gas supply in the process chamber (the opening of the first spray holes 511a are thus substantially perpendicular to the openings of the second spray hole in the outer tube). Kanai et al further teach that gas flows through sidewall apertures 511a and is mixed thoroughly with the other gas coming in the inner tube and then the mixed gas is supplied to the reaction chamber 420 (e.g. Figs. 4, 5 and col. 7, line 10 to col. 8, line 7). It would be obvious to use a concentric tube gas supply port in the apparatus of Toyoda et al as per teaching of Kanai et al to enable mix the discharge gas thoroughly before supplying the same through the showerhead type outlet of Toyoda et al to to obtain improved uniformity of plasma processing.

Toyoda et al in view of Kanai et al do not explicitly teach the inner tube having the other end as closed, the diameter of a closed portion of the other end being smaller than those of other portions of the other end, and

the other end of the outer tube being spaced apart by a predetermined interval from the other closed end of the inner tube; and

the thermal source is provided in the chamber and including a plurality of lamps for heating the wafer .

Carson teaches a fluid supply apparatus that enables mixing of fluids before supply into a process vessel 1 comprising an inner tube 5 with apertures 7 in its side walls, and closed at one end, the other end being open, and an outer tube 4 with one end that is open through which the

inner tube passes, while the other end of the outer tube is spaced apart a predetermine distance from the closed end of the inner tube (e.g. Fig. 1 and col. 2, lines 18-65). Further, unless disclosed to be critical, the size of relative diameters of the one and other ends of the inner tube would be a matter of choice depending upon level of desired mixing of gas before supply into the process chamber and could be optimized accordingly.

In this connection courts have ruled:

It would have been obvious to one having ordinary skill in the art to have determined the optimum value of a cause effective variable through routine experimentation in the absence of a showing of criticality. *In re Woodruff*, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Toyoda et al in view of Kanai et al and Carson do not teach a thermal source provided in the chamber and including a plurality of lamps for heating the wafer, the supply port and the exhaust port provided at both ends of the chamber.

Srivastava et al teach a microwave remote plasma apparatus for photo-resist stripping comprising a processing chamber 16 with a thermal source comprising a plurality of lamps 58 and having supply and exhaust ports 51, 26 provided at both ends of the chamber (e.g. Fig. 1 and col. 3, line 55 to col. 6, line 15).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide a thermal source comprising of lamps inside the chamber as taught by Srivastava et al in the apparatus of Toyoda et al in view of Kanai et al and Carson to enable precisely control the temperature on the wafer surface.

Regarding Claim 2: Srivastava et al teach inlet and exhaust ports 51, 26 are arranged at side walls of the chamber 16, and inside of chamber is symmetrical on the basis of a virtual line

connecting a lowest bottom point of the supply port 51 and a center point of an opening of the exhaust port 26 toward the process region in the chamber, and the chamber bottom is formed parallel to the wafer (Fig. 1).

Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Toyoda et al (US 2001/0029112) in view of Kanai et al (US 5,391,232), Carson (US 3,818,938) and Srivastava et al (US 6,761,796) as applied to claims 1, 2, 4, and further in view of Sojoto et al (US 2002/0015855).

Regarding Claim 3: Toyoda et al in view of Kanai et al, Carson and Srivastava et al teach all limitations of the claim except heating apparatus arranged around the supply port.

Sojoto et al teach a plasma apparatus with a chamber 112 that has a supply port 138 for receiving a heated gas delivery feed-through 140, having an inlet 142 and an outlet 144 to deliver one or more precursor gases into the gas distribution plate 126 mounted on the chamber lid assembly 114 (e.g. Fig. 3 and para. 0045).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide a heating apparatus around the supply port as taught by Sojoto et al in the apparatus of Toyoda et al in view of Kanai et al, Carson and Srivastava et al to enable control the temperature of the activated species for improved control of the plasma process.

Claims 5, 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Toyoda et al (US 2001/0029112) in view of Kanai et al (US 5,391,232), Carson (US 3,818,938) and

Srivastava et al (US 6,761,796) as applied to claims 1, 2, 4 and further in view of Zheng et al (US 2003/0066486).

Regarding Claim 5: Toyoda et al in view of Kanai et al, Carson and Srivastava et al al teach all limitations of the claim except length of supply port.

Zheng et al teach a plasma applicator with a chamber 430 that has a supply port 325 whose length is greater than the thickness of the wall of the chamber. Though Zheng et al do not explicitly teach the length of the supply port to be less than 100 mm, the same is related to functional limitations and would be selected (optimized) based upon process parameters like thickness of chamber wall, gas pressures, pumping speeds etc. (e.g. Figs. 3A-3C and para. 0072-0085).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to optimize the length of the supply port as taught by Zheng et al in the apparatus of Toyoda et al in view of Kanai et al, Carson and Srivastava et al as per process limitations like thickness of chamber wall, gas pressures, pumping speeds etc.

In this connection courts have ruled:

It would have been obvious to one having ordinary skill in the art to have determined the optimum value of a cause effective variable through routine experimentation in the absence of a showing of criticality. *In re Woodruff*, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Regarding Claim 6: Zheng et al teach the supply port 325 can have a diameter of 1 inch which meets the claim limitation of 15-25 mm (para. 0098).

Claims 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Toyoda et al (US 2001/0029112) in view of Kanai et al (US 5,391,232), Carson (US 3,818,938) and Srivastava et al (US 6,761,796) as applied to claims 1, 2, 4 and further in view of Mahawili (US 6,544,339).

Regarding Claim 7: Toyoda et al in view of Kanai et al, Carson and Srivastava et al teach all limitations of the claim including a supply port connected 51 connected to microwave plasma apparatus, and the supply port 51 and the exhaust port 26 being oppositely arranged in a one to one correspondence in the chamber (Srivastava et al – Fig. 1).

Toyoda et al in view of Kanai et al, Carson and Srivastava et al do not teach at least two supply ports and at least two exhaust ports in the chamber.

Mahawili teaches a plasma apparatus with a chamber that has a plurality of supply ports and a plurality of exhaust ports. Mahawili further teaches that the configuration of supply and exhaust ports is optimized based upon required gas flow distribution and process uniformity consideration (e.g. Figs. 3-5 and col. 6, line 30 to col. 8, line 40).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to optimize the number and configuration of supply and exhaust ports in the chamber as taught by Mahawili in the apparatus of Toyoda et al in view of Kanai et al, Carson and Srivastava et al as per process limitations like gas flow distribution and process uniformity requirements.

In this connection courts have ruled:

It would have been obvious to one having ordinary skill in the art to have determined the optimum value of a cause effective variable through routine experimentation in the absence of a showing of criticality. *In re Woodruff*, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Claims 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Toyoda et al (US 2001/0029112) in view of Kanai et al (US 5,391,232), Carson (US 3,818,938) and Srivastava et al (US 6,761,796) as applied to claims 1, 2, 4 and further in view of Sawayama et al (US 2003/0164225).

Regarding Claim 8: Toyoda et al in view of Kanai et al, Carson and Srivastava et al teach all limitations of the claim including a chamber 1, having a supply port 8A, 8B and exhaust port 9A, 9B provided at both ends thereof, with a wafer 4 being mounted in the chamber. Toyoda et al further teach an exhaust plate 7A that includes wafer transfer port (adjacent the gate valve 6) and the exhaust port 9A (Figs. 5, 6 and para. 0056-0061).

Toyoda et al in view of Kanai et al, Carson and Srivastava et al do not teach an exhaust plate on which a cooling water path is formed is arranged on a side wall opposite to the side wall on which the supply port is provided, a wafer transfer port and the exhaust port being arranged at the exhaust plate 180.

Sawayama et al teach a plasma apparatus comprising a processing chamber 6001; an exhaust pump (rotary pump and mechanical booster pump) 6002 with exhaust pipe 6003, exhaust means 6018 and water cooling means 6021, a cooling means 6021 that uses water cooling the exhaust means 6018 (e.g. Fig. 30 and para. 0173). It would be obvious to provide the water cooling means as taught by Sawayama et al in the apparatus of Toyoda et al in view of Kanai et

al, Carson and Srivastava et al to enable control the temperature of the gaseous exhaust products and the temperature of the wafer.

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide water cooling path on the exhaust plate as taught by Sawayama et al in the apparatus of Toyoda et al in view of Kanai et al, Carson and Srivastava et al to enable control the temperature of the gaseous exhaust products and the temperature of the wafer.

Claims 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Toyoda et al (US 2001/0029112) in view of Kanai et al (US 5,391,232), Carson (US 3,818,938) and Srivastava et al (US 6,761,796) as applied to claims 1, 2, 4 and further in view of Tay et al (US 6,075,922).

Regarding Claim 9: Toyoda et al in view of Kanai et al, Carson and Srivastava et al teach all limitations of the claim including lamps 58 of thermal source that heat the wafer in an upward direction (Srivastava et al – Fig. 1) and a supply port 22 that is arranged so that process gas is sprayed in parallel with the wafer in the chamber (Toyoda et al – Fig. 12).

Toyoda et al in view of Kanai et al, Carson and Srivastava et al do not teach that lamps are arranged to emit light in a downward direction and that the lamps and the supply port are arranged such that a radiation region of light emitted from the lamps and a spray region of the process gas coincide with each other above the wafer.

Tay et al teach a thermal that includes a thermal source with lamps 26 that heat a wafer 14 in a downward direction (e.g. Fig. 1 and col. 6, line 15 to col. 7, line 20). Further, since the lamps 26 heat the wafer in a down ward direction and the supply port 44 of Davis et al supplies

activated gas parallel to the substrate, a radiation region of light emitted from the lamps and a spray region of the process gas would obviously coincide with each other above the wafer.

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide thermal source with lamps that emit light in a downward direction as taught by Tay et al in the apparatus of Toyoda et al in view of Kanai et al, Carson and Srivastava et al to obtain heating of wafer simultaneous with the reaction process on the wafer surface.

Claims 10, 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Toyoda et al (US 2001/0029112) in view of Kanai et al (US 5,391,232), Carson (US 3,818,938) and Srivastava et al (US 6,761,796) as applied to claims 1, 2, 4 and further in view of Davis et al (US 2002/0144706).

Regarding Claim 10: Toyoda et al in view of Kanai et al, Carson and Srivastava et al teach all limitations of the claim including that chamber is evacuated to vacuum, but do not explicitly teach the apparatus includes a discharge pressure control valve and a vacuum pump are arranged at the exhaust port.

Davis et al teach a remote plasma apparatus comprising a remote plasma source 41 (discharge tube) that supplies activated species to a process chamber 12 through a supply port 44 `for processing a wafer mounted on a pedestal 18. Davis et al further teach a gas source 38 that supplies process gas and an exhaust port 48. Davis et al additionally teach the apparatus comprises a vacuum pump 50 and a discharge control valve 53a (Figs. 1-7 and para. 0007, 0032-0060).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide discharge pressure control valve and vacuum pump as taught by Davis et al in the apparatus of Toyoda et al in view of Kanai et al, Carson and Srivastava et al to enable obtain vacuum in the process chamber for carrying out the wafer processing.

Regarding Claim 11: Davis et al teach that the supply port 44 is designed so that divergent stream of activated gas is supplied over the wafer surface (para. 0034).

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to RAKESH K. DHINGRA whose telephone number is (571)272-5959. The examiner can normally be reached on 8:30 -6:00 (Monday - Friday).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on (571)-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Rakesh K Dhingra/
Examiner, Art Unit 1792

/Karla Moore/
Primary Examiner, Art Unit 1792